

MORE THAN JUST A POLYMER

Creating low-cost spacecraft with extensive lives and improved performance capabilities is one of NASA's goals. Thanks to a new family of polymers that goes by the name of TOR,TM NASA is one step closer to this goal. Through a **Small Business Innovation Research (SBIR)** contract from NASA's Langley Research Center, Triton Systems, Inc., of Chelmsford, Massachusetts, made a dramatic improvement to the field of aerospace materials.

TOR stands for Triton atomic Oxygen Resistant polymers. The new polymer comes from a Langley-developed polymer technology, which marks a new class of aerospace materials that resist the extreme effects of low Earth orbit (LEO). The need for materials with these resistant properties is growing as more satellites are placed in LEO. When applied to spacecraft surfaces, TOR polymers protect against erosion caused by the atomic oxygen and radiation present in space. Other polymers, such as Teflon® and Kapton®, are subject to degradation from atomic oxygen and ultraviolet radiation, but TOR polymers use atomic oxygen to their advantage.

TOR polymers contain phosphorous to provide greater resistance to the effects of atomic oxygen. When atomic oxygen and phosphorous react, a protective phosphate layer is produced that works to reduce erosion without sacrificing chemical properties. This reaction is what makes TOR polymers resistant to erosion, giving them a survival period of greater than 10 times longer than other polymers, such as Kapton. A long-lasting protective barrier means major savings in the cost of spacecraft maintenance and the time spent performing repairs.

Triton developed various processing methods for manufacturing the material. Because the polymers lend themselves to diverse forms, they can be used for diverse purposes. The TOR family of polymers is offered in the forms of powder, adhesive tape, solution, fiber, thread, fabric, or film. For instance, the fiber form of the polymer can be twisted into thread for making insulation blankets, or braided for use in tethers.

While the obvious application of this material lies with the aerospace industry, an underlying benefit is found in the field of electronics. TOR polymers are inherently resistant to high voltage, making them an excellent high-voltage insulator for power generation applications. In another version, TOR polymers can be made electrically conductive. In their



TORTM polymers are offered in a variety of forms and can be used for the protection of satellites or as high-voltage insulators.

conductive form, they can be utilized in the creation of sensors that react to the presence of chemical and biological agents by exhibiting a detectable change in electrical conductivity. These sensors have applications in the defense, medical, and industrial sectors since they can detect substances by recording changes in the resistance of conductive polymers.

Due to the increased presence of voice and data transmission, companies are focused on ways to effectively maintain their communications satellites. TOR polymers present an affordable option that will greatly extend the life of these crafts. It is projected that TOR-insulated satellites will save industry millions of dollars in annual satellite insulation repairs.

TOR is offered as a complete family of products that address a variety of LEO-based spacecraft needs. Triton is a leading materials product and process development firm that provides its customers with superior solutions. Triton and Langley Research Center were jointly awarded the R&D100 award for the year 2000—presented for the 100 most technologically significant new products of the year. ♦

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